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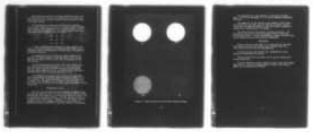

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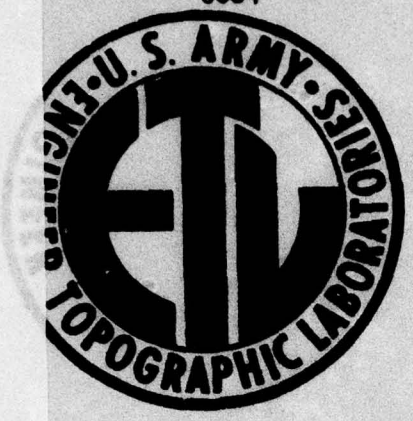

POINT LIGHT SOURCE CONTACT PRINTER

PHOTOGRAPHIC TECHNOLOGY SERIES

September 1976

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This report describes the point light source contact printer built in-house and the exposure characteristics of the light source. Tests performed in the printer were to determine uniformity and repeatability of the exposure.

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ILLUSTRATIONS

SUMMARY

This report describes the point light source contact printer built in-house and the exposure characteristics of the light sources.

Tests performed in the printer were to determine uniformity and repeatability of the exposure.

The report concludes that:

a. The printer can be used to make contact prints from 9" x 9" (23 x 23 cm) negatives and from 70mm x 9" (23 cm) strips.

b. Uniform density area without dust specks can be exposed for photo material testing.

c. Exposures made with the printer can be used for testing processing uniformity.

d. With the addition of neutral density filters, plus the variable power switch, a variety of film speeds can be exposed on the printer.

PREFACE

The authority for the construction and the tests described in this report is contained in Project 4A762707A855 entitled, "Development of Improved Photo Materials and Processes."

The author would like to express his appreciation for help received from the following ETL employees: Mr. A. Hecht for helping with the original mockup; Mr. R. Rollins for making the shop drawings; Mr. E. Stiffler for the electronic wiring of the printer; and Mr. J. Odell, Photo Team Leader.

Other reports in the Photographic Technology Series are:

Report No.	Author	Title
ETL-ETR-70-9	Gunther Schwarz	Color Contact Printer Mark IV
ETL-TR-72-4	Richard K. Roedel	Controlled Color for Contact Printing Aerial Imagery
ETL-TR-73-1	Gunther Schwarz	Agfa Contour Film
ETL-0014	John W. Eastes	Image Enhancement by Chemical Intensification

POINT LIGHT SOURCE PRINTER

INTRODUCTION

Subject. This report covers the designing, constructing, and testing of a point light source contact printer.

Background. For several years, the Technology Development Branch of the Geographic Information Systems Division, U.S. Army Engineer Topographic Laboratories (USAETL) has had the responsibility for testing new photographic materials and developing minor photo equipment.

In testing photographic films, one of the biggest problems is dust. When making microdensitometry scans for granularity tests across a sample exposure, it must be uniformly exposed. Any variation, such as pinholes, owing to dust particles will make measurements extremely difficult, if not impossible.

With this in mind, a relatively simple exposure device was constructed that would have (1) a dust-free exposure for film testing, and (2) a point light source. In addition, the device required a minimum cost to build and to maintain.

The first problem of having a dust-free exposure was solved by using a glassless stage. The second problem of creating a point light source was solved by making a cardboard mockup that incorporated an optical rail. With this mockup, we determined the distance from the aperture to the printing stage, the size of aperture, and the distance of the light source to the aperture. These tests were performed using a 250W Tungsten halogen lamp. At this time, we decided that the heat of the lamp would make the printer more complex than originally thought. Cooling fans and heat absorbing glass would have to be installed for efficient use. The alternative light source was a Graflex Stroboflash IV, which had been in the Technology Development Branch for some time.

After the preliminary tests were completed, the designs for the printer were made and forwarded to the Mobility Equipment Research and Development Command (MERADCOM) sheet metal shop at Fort Belvoir.

TEST

Description. The dimensions of the printer are 26 inches (66 cm) wide, 18 inches (46 cm) deep, and 56 inches (142 cm) high. The electrical power is 115V a.c. The light source is a strobeflash unit with a maximum output of 200 watt seconds. The input voltage of 450V a.c. is supplied by two power supplies hooked up in series.

The flash unit has the capability for operating at full, 3/4,1/2, and 1/4 light output. The complete specifications for the strobelight are listed in table 1.

Table 1. Flash Specifications

Light output setting	Full	3/4	1/2	1/4
Watt seconds	200	150	100	50
Flash duration (seconds)	1/400	1/600	1/800	1/1200
Recycling time (seconds)	6	5	3	2

The flash unit and power supply are located in the lower part of the printer.

Separating the lower and upper part of the printer is a metal plate. In the center of the plate is a 2-inch (5 cm) opening, in which is centered a 1/8-inch (3.2 mm) aperture. This aperture is interchangeable with larger apertures when needed. Inside the upper part of the printer is an incandescent viewing light. The switches controlling the operations are located in the front of the printer (figure 1).

Switch A is the main power switch; B is an instant return rocker switch that sets off the flash unit; C is an on/off switch for the viewing light; and D is the control switch for determining the light output. In addition, there is a neon lamp indicating when the flash unit has recycled.

The stage plates are designed to accommodate a 9- by 9-inch (23 by 23 cm) aerial image, a 70mm by 9-inch (23 cm) strip, and a 2-inch (5 cm) diameter test exposure area. When printing from a 9- by 9-inch (23 by 23 cm) area, a glass stage plate is placed in the printing plane. For 70mm format, this glass is removed and replaced with a black metal stage plate having a 70mm x 245mm opening (figure 2). A glass stage is placed in this opening for printing 70mm chips or strips. When an exposure is to be made for material testing, the insert with a 2-inch (5 cm) opening replaces the 70mm glass stage (figure 3). This 2-inch (5 cm) opening can be modified by inserting the various apertures shown in figure 3.

The pressure platen is a spring-loaded top with a foam rubber pad creating the pressure. On each side of the printer is a set of adjustable film spool holders.

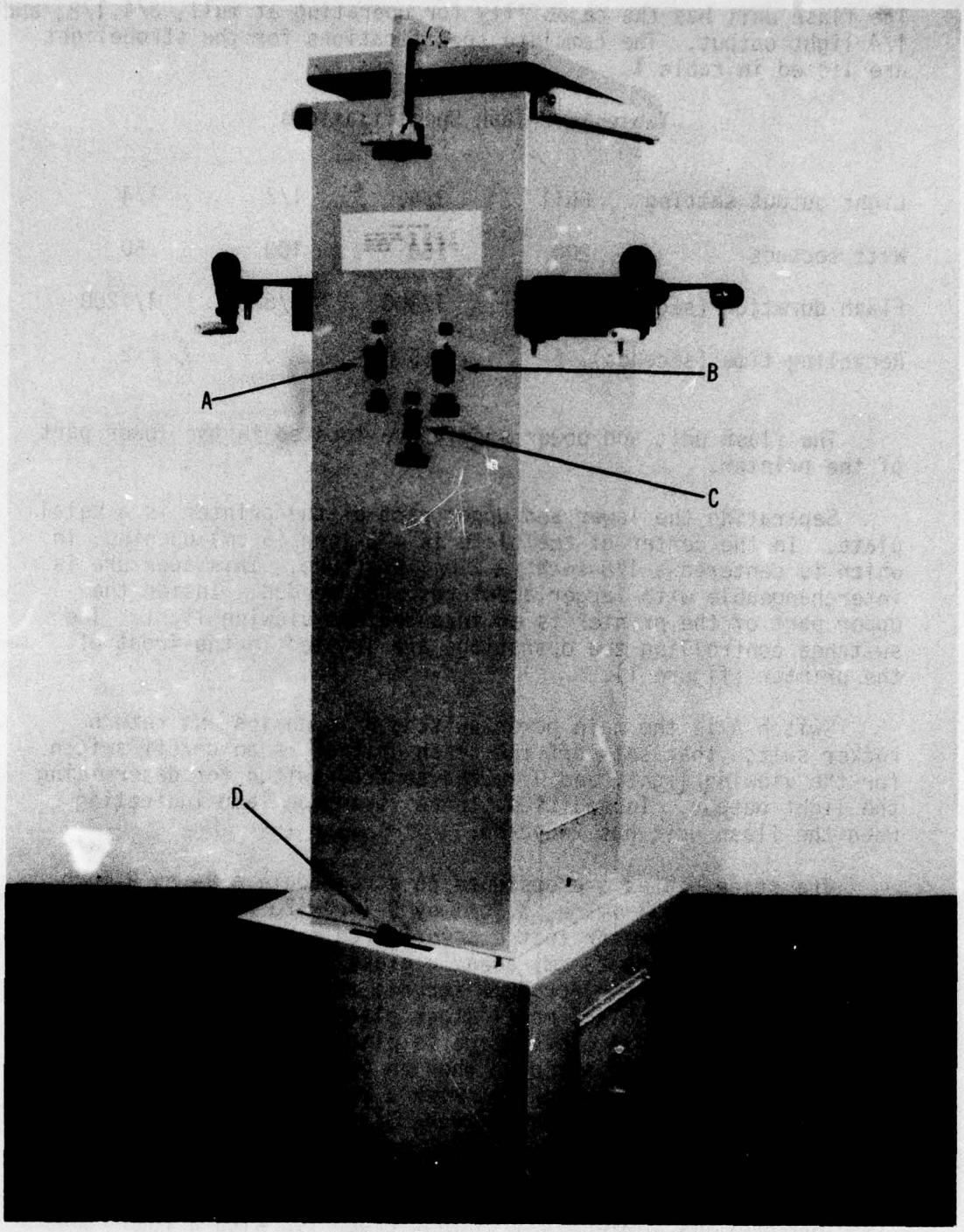

Figure 1. Point Light Source Printer

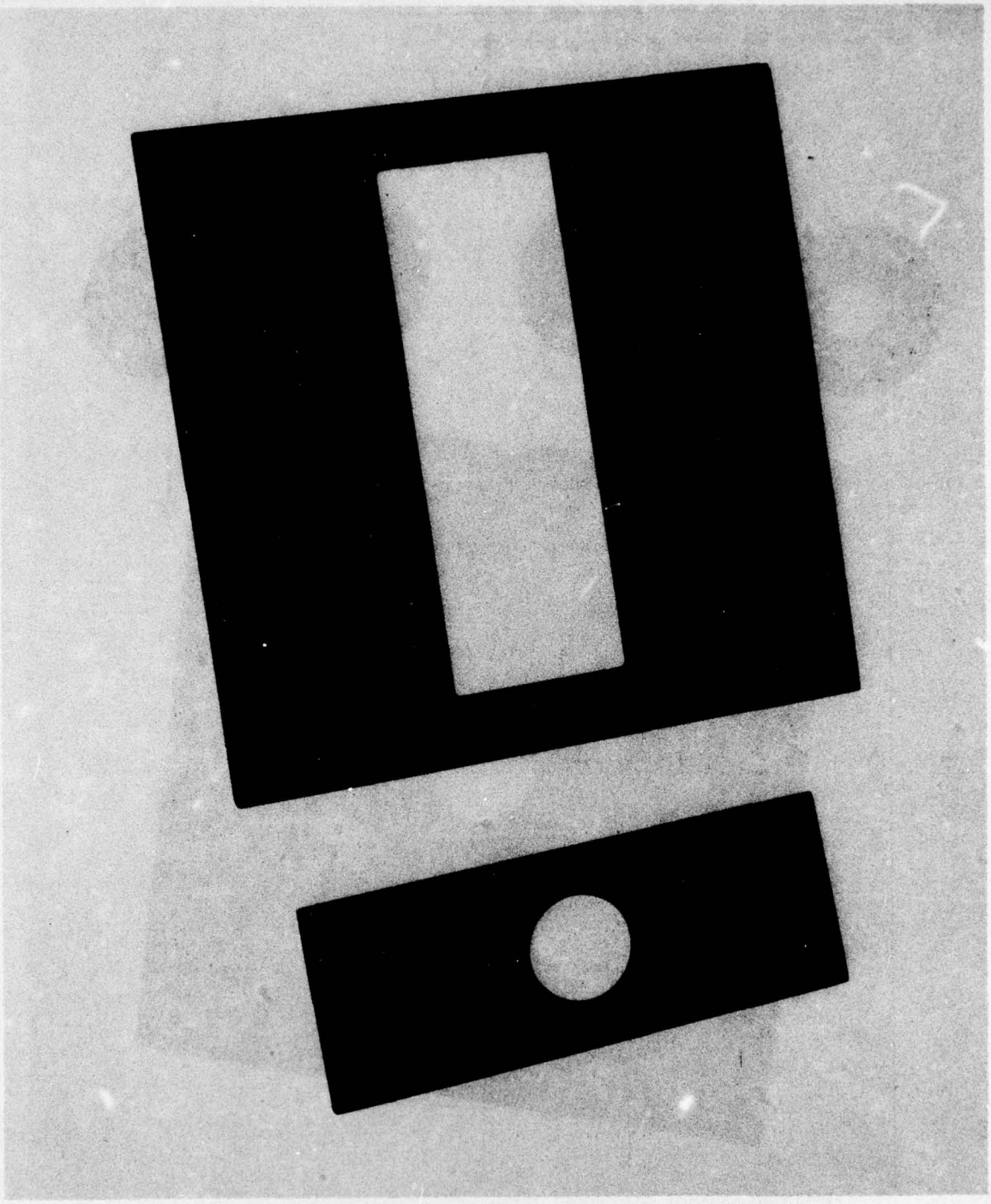

Figure 2. Printing Stage Plates

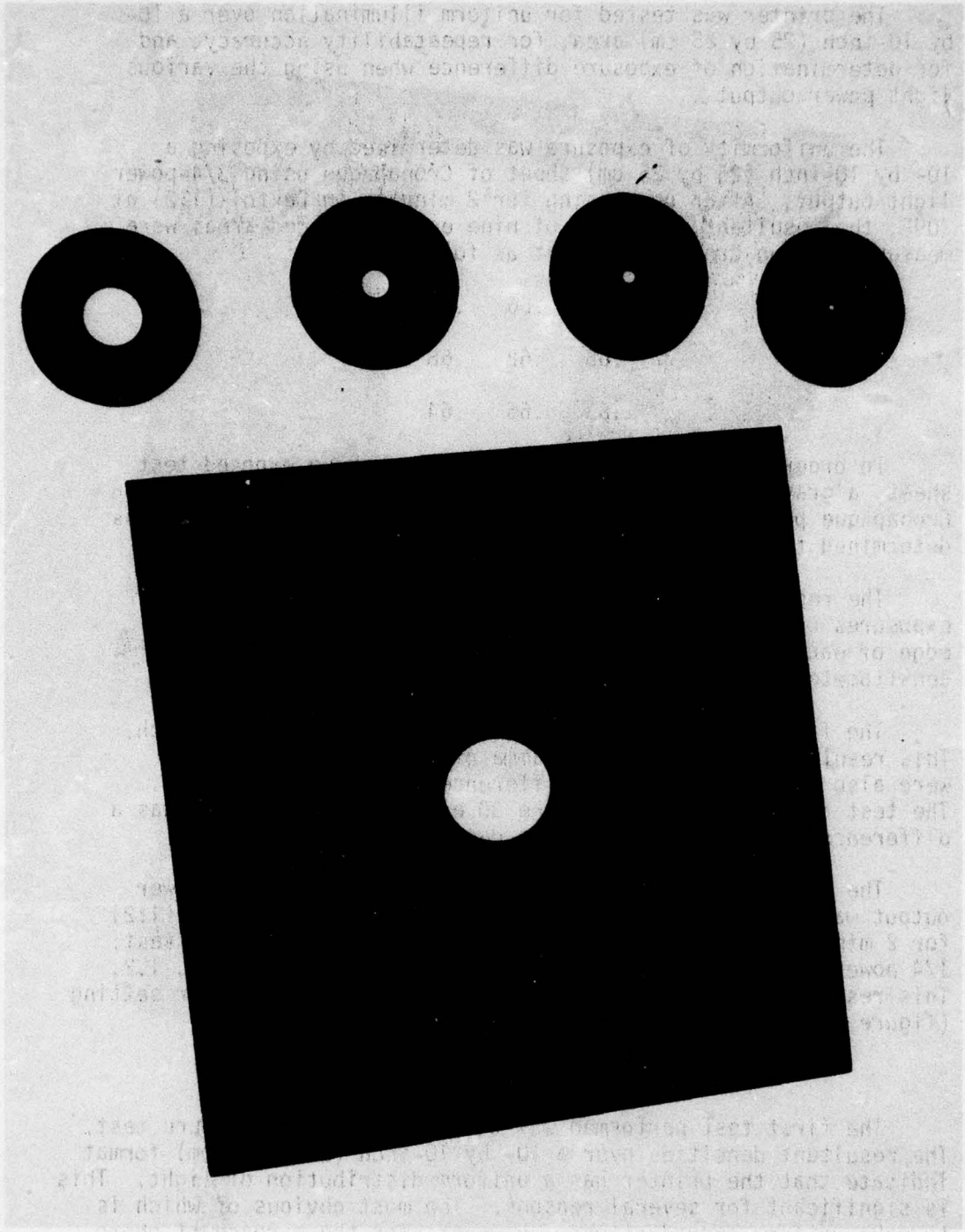

Figure 3. Film Test Stage Plates and Apertures

The printer was tested for uniform illumination over a 10- by 10-inch (25 by 25 cm) area, for repeatability accuracy, and for determination of exposure difference when using the various light power outputs.

The uniformity of exposure was determined by exposing a 10- by 10-inch (25 by 25 cm) sheet of Cronapaque using 3/4-power light output. After processing for 2 minutes in Dektol (1:2) at 70°F, the resultant densities of nine equally spaced areas were measured on the Cronapaque print as follows:

.62	.66	.66
.65	.68	.68
.63	.66	.64

In order to determine the gamma of the above exposed test sheet, a gray scale exposed with a MacBeth sensitometer, also on Cronapaque paper, was processed at the same time. The gamma was determined to be 3.0.

The repeatability of the flash was tested by making 30 exposures on several sheets of 2420 duplicating film. At the edge of each sheet of film, a gray scale was exposed with the sensitometer.

The film samples were processed in D19 for 6 minutes each. This resulted in a processing gamma of 1.9. The gray scales were also used to adjust any differences owing to processing. The test results show that of the 30 exposures made, there was a difference of $\pm$ .02 at an average density of 1.01.

The difference of exposure when switching the light power output was tested on Chronapaque paper processed in Dektol (1:2) for 2 minutes. The following densities resulted from this test: 1/4 power, .23; 1/2 power, .56; 3/4 power, .89; full power, 1.2. This results in a difference of one stop between each power setting (figure 4).

DISCUSSION OF TESTS

The first test performed was the uniformity of exposure test. The resultant densities over a 10- by 10-inch (25 by 25 cm) format indicate that the printer has a uniform distribution of light. This is significant for several reasons. The most obvious of which is to make uniform reproductions. However, for the purpose of photo processing tests, this exposure uniformity is very useful in determining process uniformity in that one variable is eliminated.

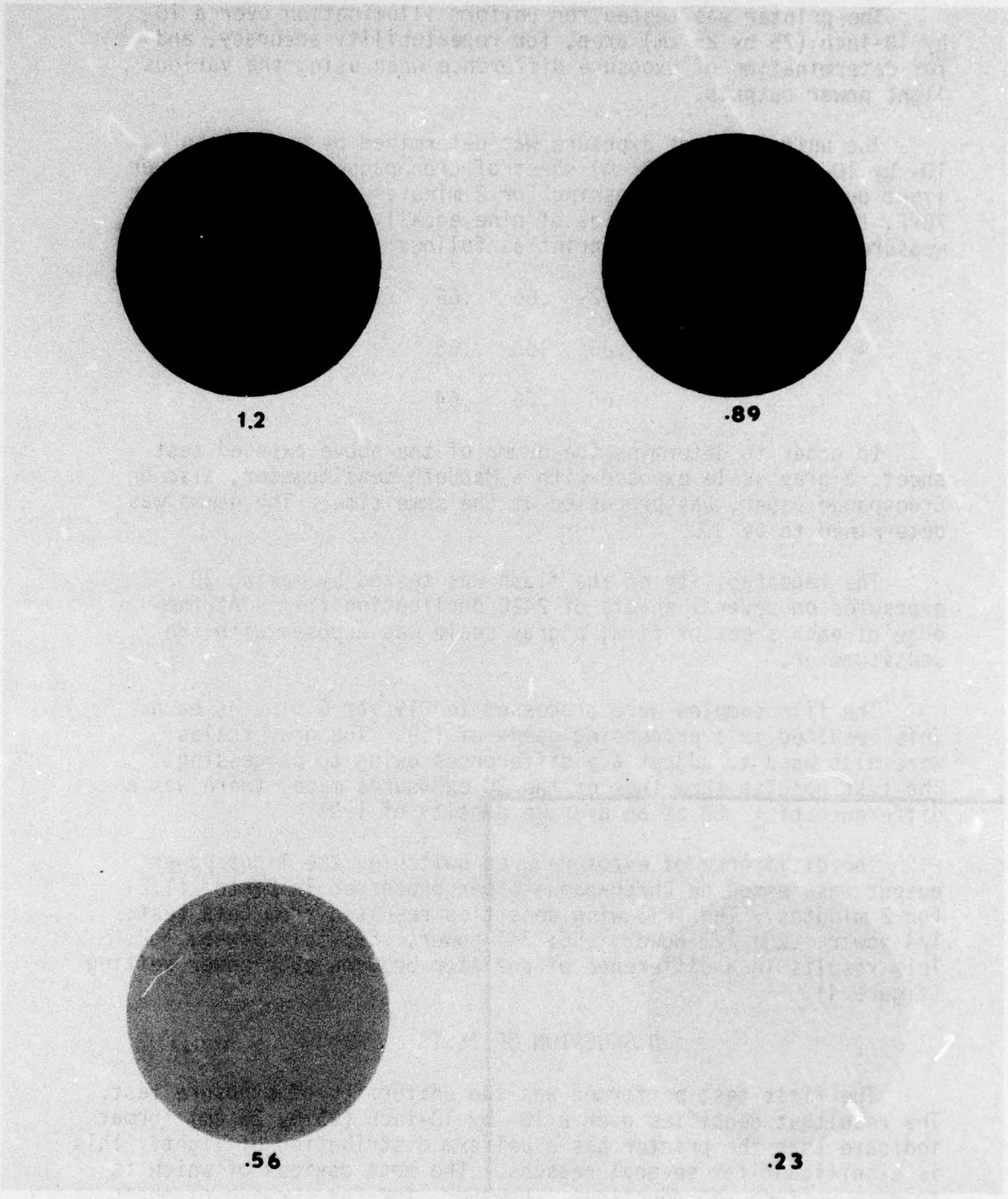

Figure 4. Density Results with Variable Exposure Settings

The repeatability of the exposure is considered extremely good. The ±.02 at the gamma of 1.9 is within expected photographic tolerance.

The capability of the exposure to be changed by three steps, (in intervals of one step) plus the addition of neutral density filter over the exposure aperture, gives the printer a capability ranging over a broad band of film speeds.

The construction of the printer is highly functional. The electronics can be easily serviced through a door on the lower part of the printer. If major replacement is needed, the base plate can be removed to reach the electronics components.

CONCLUSIONS

Based on the tests described, it is concluded that the point light source printer can be used to make contact prints from 9- by 9-inch (23 by 23 cm) and 70mm negatives.

A uniform density area without dust contamination can be exposed for photo material testing.

Exposures made with the printer can be used for testing processing uniformity.

With the addition of neutral density filters, plus the variable power switch, a variety of photo material having a wide range of speeds can be exposed on the printer.